

# *Integrated Management of Virus Diseases of Small Fruit Crops*

## **ARS LOCATION:**

Horticultural Crops Research Unit  
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## **PRINCIPAL INVESTIGATOR:**

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## **PROJECT OBJECTIVES:**

1. Characterize viruses of Grapevine in the Pacific Northwest.
2. Evaluate diversity of viruses of grapevine in the Pacific Northwest.
3. Identify vectors and develop vector management strategies for viruses of grapevine.
4. Evaluate impact of virus infections on fruit quality parameters.

## **MAJOR ACCOMPLISHMENTS (2007–2010):**

### Characterize viruses of grapevine in the Pacific Northwest:

We have identified Grapevine leafroll associated viruses (GLRaV), 1, 2, 3, 4, 5, 6, 7 and 9 in the Pacific Northwest (PNW). In collaboration with entomologists in the PNW, the grape mealybug has been detected in relatively high populations in the warm drier parts of the PNW, including southern and eastern Oregon, eastern Washington and in Idaho. In these areas, it appears that GLRaV-3 is moving relatively quickly. Mealybug populations in the Willamette Valley appear to be relatively low or absent in many vineyards and GLRaV-3 spreads very slowly. GLRaV-2 is more of a problem in the Willamette Valley than in other parts of the PNW, this is likely due to the fact that many of these vineyards are on rootstocks and thus there is more opportunity for introducing the virus. Grapevine rupestris stem pitting associated virus (GRSPaV) is present in all areas of the PNW and surprisingly, in the Willamette Valley infection of individual vines with multiple strains of GRSPaV is quite common, suggesting that the virus was present in the rootstock and scion prior to grafting. In areas with nongrafted vines, infection with multiple strains of GRSPaV was rare. Tomato ringspot virus was detected in a single vineyard in the PNW, even though the vector (*Xiphinema americanum*) is widespread in PNW vineyards. Grapevine fanleaf virus (GFLV) was detected in several vineyards in Washington greater than 10 years old, with no evidence of spread within the vineyards, suggesting that the virus came in on infected wood. This lack of spread is consistent with the failure to find the GFLV vector (*Xiphinema index*) in vineyards in the PNW. Additionally, several of the viroids of grapevine were found widely distributed in vineyards in the PNW.

### Evaluate diversity of viruses of grapevine in the Pacific Northwest:

Virus diversity studies have been carried out with GLRaV-2, GRSPaV and GFLV. In these studies, several genes of multiple isolates of the viruses, more than 50 in the case of GRSPaV, were sequenced. This serves two goals, one to determine if there were multiple introductions of a virus, but more importantly to be able to identify highly conserved sequences that can be used to develop detection primers for reverse transcriptase-polymerase chain reaction (RT-PCR) that will detect each of the isolates. This strategy provides a detection method that is broad spectrum and should detect all isolates of a given virus.

Vector identification and monitoring are done in collaboration with entomologists at Oregon State University, Idaho State Department of Agriculture, Washington State University, and with nematologists at the ARS Horticultural Crops Research Unit in Corvallis.

The impact of infection of GLRaV-2/GRSPaV and GLRaV-3/GRSPaV have been studied in commercial fields using self-rooted and grafted vineyards. In these cases the virus infection reduced anthocyanin content. A research vineyard has been established, where a single clone of Pinot noir has been grafted on four different rootstocks and as well as self rooted. This vineyard has been grafted with controlled virus infections (GLRaV-3, GLRaV-2, GLRaV -2 + 3), GRSPaV, GRSPaV in combination with the GLRaVs, and uninfected. This vineyard will be used to evaluate fruit quality beginning in 2011.

#### **TECHNOLOGY TRANSFER/OUTREACH:**

- Extension publications have been produced in cooperation with the extension viticulturist and entomologists at Oregon State University and by Washington State University.
- Field days for vineyard managers and extension agents to show virus symptoms, how to search for mealybugs, and explain how to manage the mealybugs and prevent virus spread were held in Idaho, Oregon, and Washington.

#### **EXTERNAL SUPPORT:**

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#### **COLLABORATORS:**

Dr. Rayapati Naidu (Virologist), Dr. Douglas Shaw (Entomologist), and Dr. Ken Eastwell (Virologist), Washington State University, Prosser, WA; Dr. Alexander Karasev (Virologist), University of Idaho, Moscow, ID; Dr. Ioannis Tzanetakis (Virologist), University of Arkansas, Fayetteville, AR; Dr. Adib Rowhani (Virologist), University of California, Davis, CA; Dr. Rodrigo Almeida (Virologist) and Dr. Kent Daane (Entomologist), University of California, Berkeley, CA; Dr. Patty Skinkis (Extension Viticulturist), Dr. Vaughn Walton (Entomologist), and Dr. Amy Dreves (Entomologist), Oregon State University, Corvallis, OR; Dr. Ben Simko (Entomologist), Idaho State Department of Agriculture, Boise, ID; Dr. Inga Zasada (Nematologist), ARS Corvallis, OR; Dr. Jungmin Lee (Food Chemist), ARS Parma, ID; Dr. Marcus Buchanan (Extension Viticulturist), Oregon State University, Medford, OR; Dr. Clive Kaiser, Oregon State University (Extension Viticulturist), Milton-Freewater, OR; Dr. Steve Castagnoli (Extension Viticulturist), Oregon State University, Roseburg, OR; Dr. Steve Renquist (Extension Viticulturist), Oregon State University, Hood River, OR; and Dr. Rick Hilton (Extension Entomologist), Oregon State University, Medford, OR.

## RECENT PUBLICATIONS:

- Pinkerton, J.N., Kraus, J., Martin, R.R. and Schreiner, R.P. 2008. Epidemiology of *Xiphinema americanum* and *Tomato ringspot virus* on red raspberry, *Rubus ideaus*. Plant Dis. 92:364-371.
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- Alabi, O.J., Martin, R.R. and Naidu, R.A. 2010. Sequence diversity, population genetics and potential recombination events in *Rupestris stem pitting-associated virus* in Pacific Northwest Vineyards. J. Gen. Virol. 91:265-276.
- Lee, J. and Martin, R.R. 2010. Analysis of grape polyamines from *grapevine leafroll associated viruses* (GLRaV-2 and -3) infected vines. Food Chem. 122:1222-1225.
- Skinkis, P., Pscheidt, J., Walton, V., Peachey, E., Sanchez, D., Zasada, I. and Martin, R.R. 2010.
- 2010 Pest Management Guide for Wine Grapes in Oregon.  
<http://ir.library.oregonstate.edu/jspui/bitstream/1957/16093/1/em8413.pdf>